The University of Minnesota
AGRICULTURAL EXTENSION DIVISION
Special Bulletin No. 63
University Farm, St. Paul May 1922

Published by the University of Minnesota, College of Agriculture, Extension Division, F. W. Peck, Director, and distributed in furtherance of the purposes of the coöperative agricultural extension work provided for in the Act of Congress of May 8, 1914.

TUBERCULOSIS OF POULTRY

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HISTORY

Tuberculosis is one of the oldest known diseases of man and animals. It was known to exist many years before the actual cause was discovered. Descriptions of this disease were written as far back as five hundred years before Christ. Even in those early days it was recognized to be contagious. For hundreds of years afterward little was known concerning the exact cause altho there were many superstitious beliefs. In the beginning of the nineteenth century tuberculosis was widely distributed among man and all classes of animals, but the diagnosis was made only on the changes found in the diseased tissues. Pasteur, in the middle of the nineteenth century destroyed the existing theory of spontaneous generation and showed conclusively that bacteria, or germs, were responsible for many diseases known to be of a contagious or infectious nature. The attempt to discover the cause of tuberculosis received a new impetus. In 1882 Robert Koch, a German scientist, discovered that tuberculosis was caused by a very small germ which can be seen only under the microscope. This original work was carried on with human tuberculosis. Shortly after this it was found that Avian or fowl tuberculosis was caused by a similar organism. Even before Koch's discovery it had been shown that a healthy bird could be infected by feeding it diseased tissues taken from a fowl dead of tuberculosis.

Since that time the disease has been demonstrated in practically all kinds of domesticated birds and in many of the wild ones which have been raised in captivity. About 1880 the zoos of the old world were found to be infected, making it almost impossible to raise birds which were brought north from the tropics.

Tuberculosis in poultry has existed in the United States for many years. We have several descriptions of it, but in no case was it positively identified by bacteriological examination until 1900

when Pernot, working in the State of Washington, made the first positive diagnosis in this country. Since then its recognition has been rapid in the various states. In 1908 Beebe was the first positively to identify the disease in Minnesota. At the present time it is widespread throughout this state. There are few counties where it has not been found. The losses have been very heavy, in some flocks as high as 30 per cent. Owing to the insidiousness with which it spreads, control methods have been difficult. Its economic importance makes it a constant menace to the poultry industry. If methods of eradication are to succeed, it is necessary that the disease be recognized early and effective measures taken to prevent its further spread.

OTHER NAMES FOR TUBERCULOSIS

There is no other disease of poultry which has been mis-named more often than tuberculosis. Many of the older poultry books dealing with disease, speak of it as "going light," liver disease, consumption, indigestion, bowel trouble, rheumatism, speckled or spotted liver, etc. The name "going light" was probably used because the birds become very thin and light in weight, while "bowel trouble" might have referred to the chronic diarrhea found in the later stages of the disease.

Liver disease, spotted and speckled liver, were used when the liver was found to be involved. When the infection affected the joints, as it sometimes does, or from extreme leanness (emaciation) or weakness the bird was noticed to limp, the term rheumatism was applied. All these terms are very confusing, and in practically all cases refer to tuberculosis of poultry. Partly because of these improper designations, many poultrymen still believe tuberculosis is due to improper feeding methods and other causes equally irrelevant.

CAUSE OF TUBERCULOSIS

Tuberculosis is caused by a very small germ or organism which can be seen only with the aid of a powerful microscope. There are three distinct types of the organism, varying slightly in appearance. The human type causes tuberculosis in man, the bovine type in cattle and hogs, and the avian type in birds and sometimes in hogs. There is some difference of opinion as to whether birds may become infected with the bovine type and vice versa. There may be instances when birds become infected from man or cattle

if the exposure is continuous, but in practically all cases the disease is brought into a healthy flock through the introduction of infected birds.

The germ is easily destroyed by any of the common disinfectants used on the farm. Sunlight is also a great agent of destruction. The bacteria are present in much greater numbers in chickens than in either man or animals.

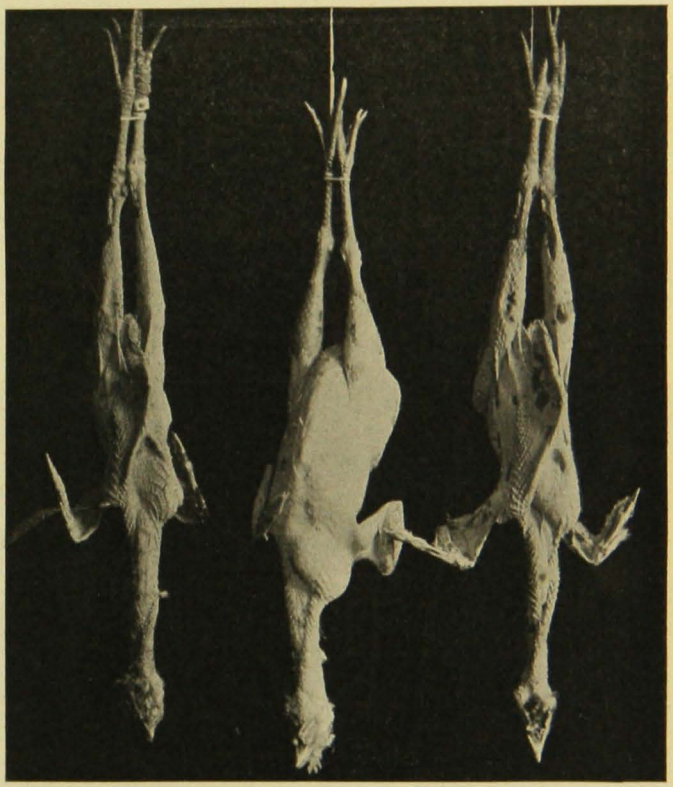

Fig. 1. Healthy and Diseased Fowls
The dressed fowl in the center is healthy. The two outer ones are tuberculous. Note the absence of breast muscles. This latter condition is known as "going light."

SYMPTOMS OF TUBERCULOSIS

The symptoms exhibited, while comparatively uniform, are sometimes varied enough to cause some confusion to the poultryman. In an apparently healthy flock the disease may progress for months without being noted. In the beginning there may be few deaths. The loss of a bird now and then is not considered cause for alarm, and the death passes unnoticed, the cause being often laid to

external injuries of some sort. This attitude allows the disease to gain a foothold, because little concern is shown until the birds begin to die in ever increasing numbers.

The birds become thinner and thinner. The appetite may remain good but the birds fail to put on flesh.

A bird which normally should weigh several pounds will often weigh but two or three pounds (see Fig. 1). The breast is very thin and in some instances there are practically no breast muscles. Upon passing the hand over that portion between the back part of the breastbone and the vent (cloaca) one may find the muscles so shrunken that the enlarged liver may easily be felt. Many times the liver is so much increased in size and weight as to cause the abdomen to hang low at this point. This condition is usually seen in the older birds of the flock, because the disease progresses slowly and the birds are as a rule in their second year before they begin to show the effect of the infection. While we wish to lay special emphasis upon the loss of flesh over the breastbone and lightness of weight, it sometimes happens that a bird may be in apparently good condition and still be badly diseased.

Fig. 2. Tuberculous Fowl Showing Ruffled Feathers, Arched Neck, and Drooping Wings

Lameness is often mentioned as an early symptom and indicates an infection of the joints. It is true that the disease sometimes affects the joints and when it does, lameness results. It is believed, however, that most of the lameness, or leg weakness as we prefer

to call it, is not so much due to joint infection as to the fact that the bird becomes so weak from loss of flesh and vigor as to appear lame and is sometimes unable to stand. This of course happens in the later stages of the disease.

Fig. 3. Fowl Opened Showing Tuberculous Liver

Note large size of liver, almost filling the abdominal cavity. This is the condition often called speckled or spotted liver.

The comb and wattles, normally bright red in color, become pale or colorless. The bird is no longer active and seeks to be by itself, presenting a general unthrifty appearance. The feathers are ruffled and as the weakness progresses, the wings may droop (see Fig. 2). Diarrhea develops and increases in intensity until death. The droppings are yellow and watery in character and usually ill smelling. The feathers about the vent become matted.

Fig. 4. Liver Cut in Slices, Showing Dead Areas of Tissue All Through the Organ

POST-MORTEM EXAMINATION

Tuberculosis is one of the easiest diseases to recognize upon examination after death. There are, however, a few conditions sometimes found which may be mistaken for it. It is well to keep in mind the symptoms evidenced before death and if possible connect them with the changes found after death. Before opening the bird, carefully examine it for enlargement of the joints, thinness over the breastbone, etc. The internal organs most commonly affected are

the liver, spleen, and intestines. As a rule, if evidence of the disease is not shown in one of these three organs, no other lesions will be found. The lungs may be affected, but this is not common.

Liver.—The liver is almost always increased in size. It is paler than normal in color, easily broken, and has a cooked appearance. It may even be so large as to occupy practically all of the abdominal cavity (see Fig. 3). On the surface of the liver are found yellowish white areas varying in size from a pin point to a hickory nut (see Figs. 3 and 4).

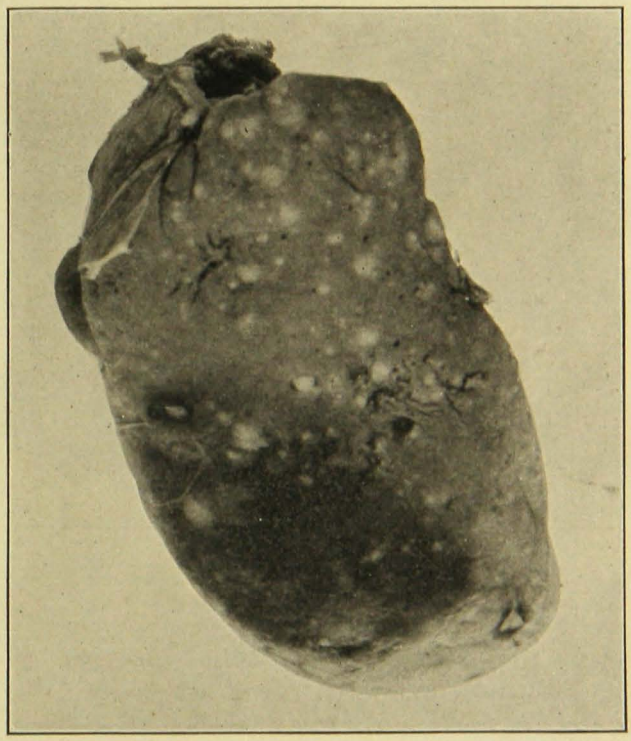

Fig. 5. Ruptured Liver

The darkened area is the point of hemorrhage. The liver is very friable, or easily broken.

The larger spots are slightly raised above the surface. If the liver is sliced it will be seen that these areas of dead tissue extend throughout the liver. The inside of these areas is of a dry yellow character, and may grit as the knife passes through (see Fig. 4). Many times upon opening a bird, the abdominal cavity will be found filled with a red fluid. This is blood and usually comes from either a ruptured liver (see Fig. 5) or spleen. These organs will

be greatly enlarged and so friable that the capsule covering them is very easily broken. The resulting hemorrhage may cause the death of an apparently healthy bird. Jumping from a high roost might cause the organs to rupture if the bird is large and heavy.

Spleen.—This is a small and nearly round organ, found just underneath the liver. Normally it is reddish purple in color and about three quarters of an inch in diameter. The size, of course, may vary. When diseased, the spleen sometimes becomes as large as a walnut or even larger (see Fig 6). Nodules are found in the spleen similar to those in the liver. The enlargement may be so great as to cause a rupture of the covering of the spleen.

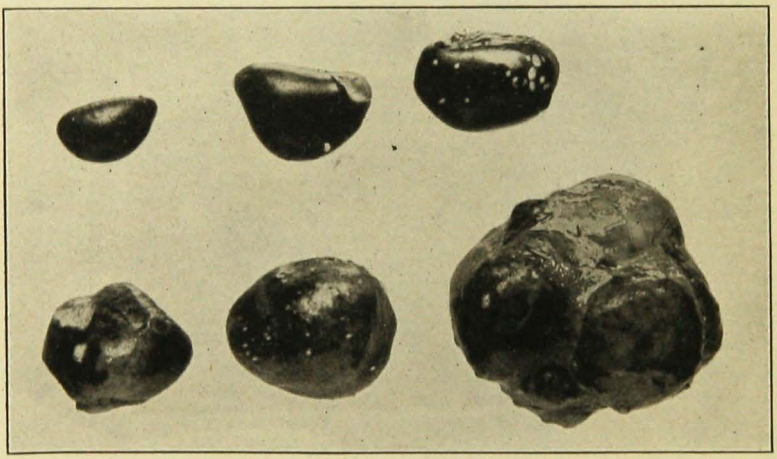

Fig. 6. Six Spleens
The upper left one is of normal size. The others show different degrees of enlargement and are tuberculous.

Intestines.—Examine the surface carefully for small tumor-like nodules on the outside of the intestinal wall (see Fig. 7). They are of various sizes from almost invisible to as large as the thumb. They are irregular in shape and grayish or yellowish white in color. When cut into, the centers are found to be dry and yellow. There may be only one or two of these nodules or there may be several dozen. They may sometimes be so large and so numerous as to interfere with the passage of food through the intestines.

Lungs.—It is exceptional to find the lungs affected. The lesion is in the nature of an abscess rather than the hard dry nodules such as are seen in the liver, spleen, and intestines. Usually there are only one or two of these.

Joints.—The joints are not commonly affected. When they are, the condition is often called rheumatism. In several hundred cases

examined, we have seen very few. When tuberculosis does attack the joint, it becomes enlarged or swollen. There may be a discharge from it. If opened, a yellowish deposit will be found similar to that occurring in the liver and intestinal nodules. This condition causes the bird to be lame.

Skin.—Lesions are sometimes found in the skin, but they are rather rare. When they do occur (see Fig. 9), they are in the form of round masses of dead tissue which may become open ulcers. Tuberculosis ulcers have also been found on the legs and breastbone (see Fig. 8). Microscopic examination of some of the infections of the foot shows them to be tuberculous.

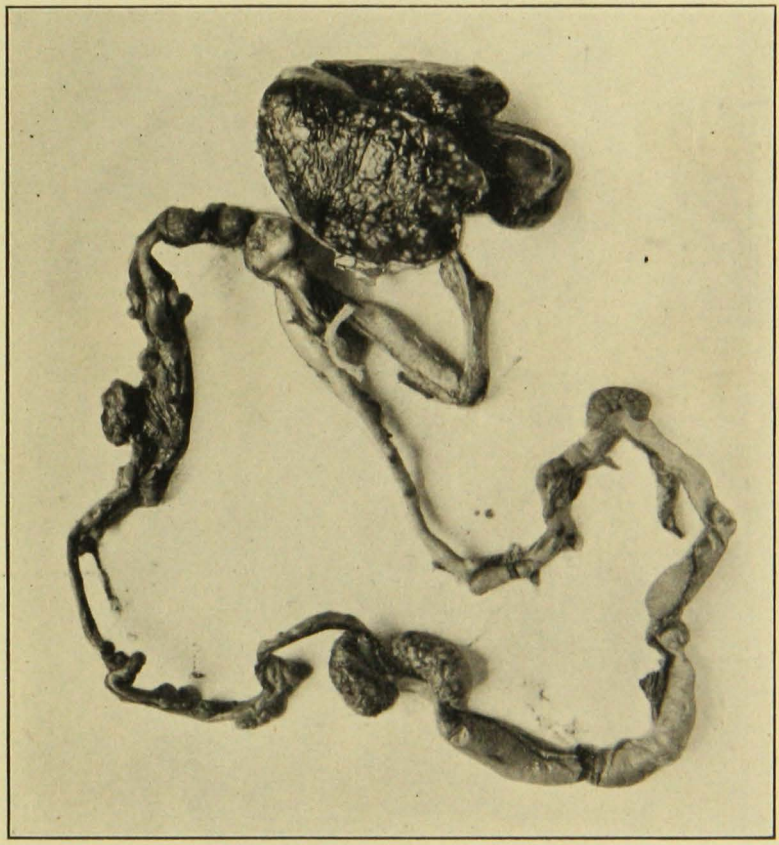

Fig. 7. Tuberculous Liver and Intestines

Note tumor-like enlargements or nodules attached to the outside wall of the intestines. They are grayish or pearl-white in color.

HOW THE DISEASE SPREADS

Tuberculosis in chickens nearly always attacks the digestive organs primarily. This being true, it is easily seen that the germs pass out in great numbers through the droppings. It has been found that the droppings of infected birds contain millions of germs. Thus the floor of the poultry house becomes germ laden and also the soil of the yards. When open drinking vessels are used,

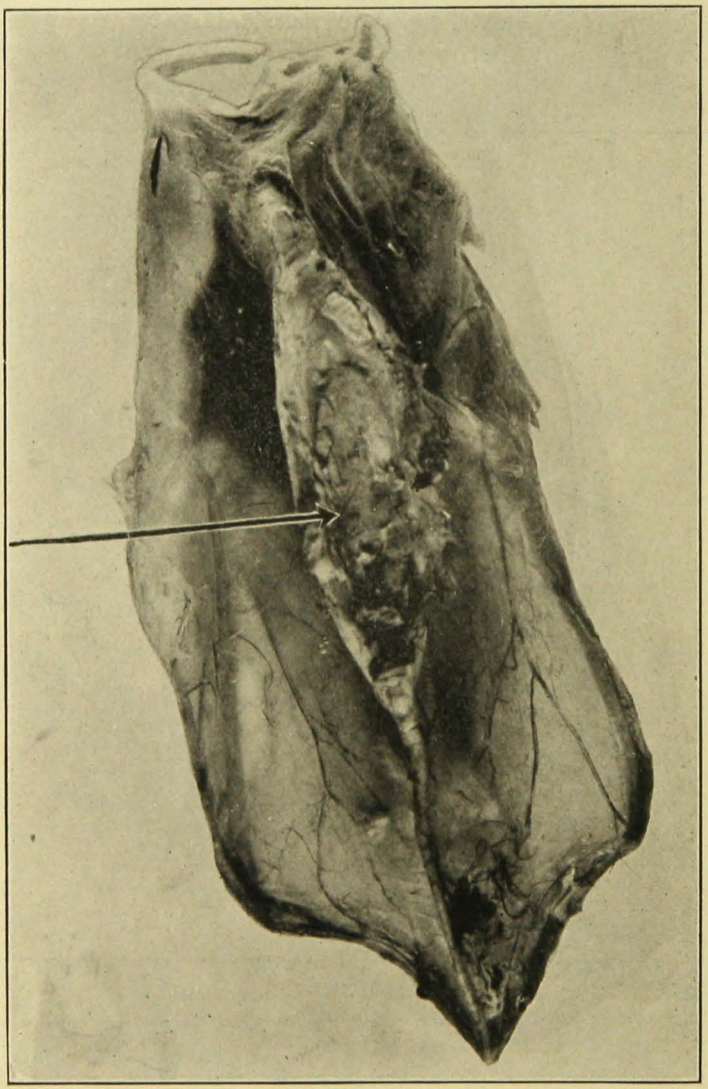

Fig. 8. Breastbone Showing Diseased Area
Note also complete lack of flesh.

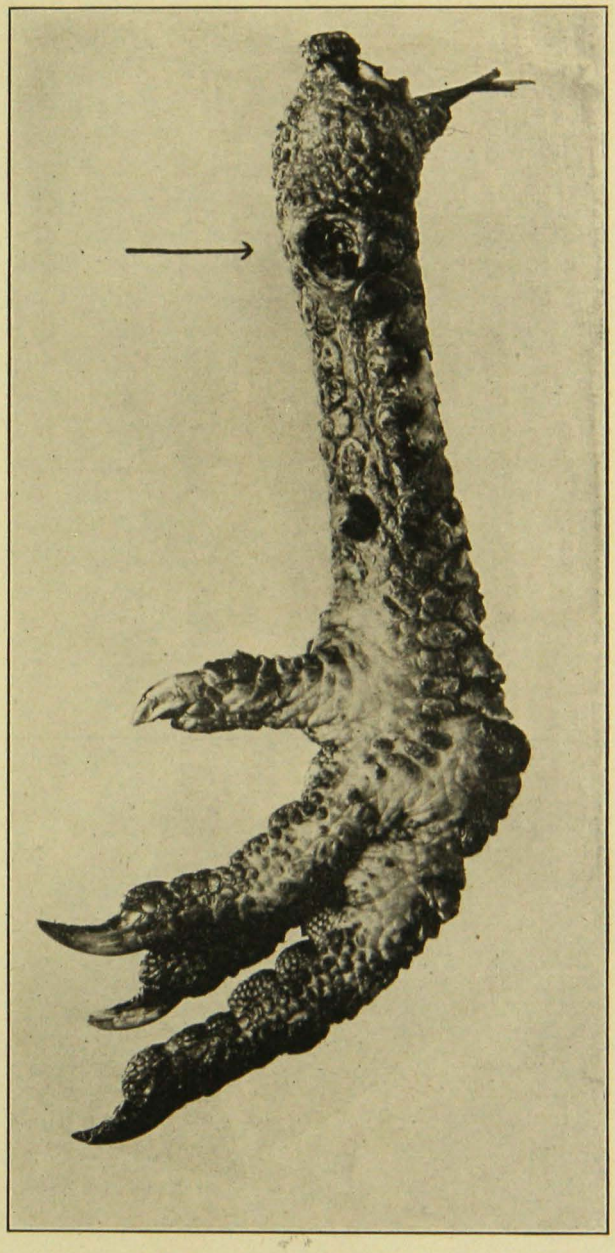

Fig. 9. Part of Leg and Foot

An open tubercular abscess is seen on the upper end near the joint.

the water may become polluted with the droppings of the diseased birds and healthy ones may easily become infected by drinking. In many instances the chickens are fed from the floor or ground which is covered with contaminated litter and droppings. In this way they may take in the germs with the feed. The disease is usually introduced through the purchase of a bird from another, infected flock. Great care should be exercised to see that all purchased birds are from flocks known to be free from tuberculosis. There is a possibility of its being carried from one farm to another by rats and mice and birds of the air. This method is not likely to be of very great importance. The possibility of spreading this disease through the eggs from infected birds is very small. Experiments have shown that infected eggs rarely hatch. This fact should allay any fears that the custom of buying hatching eggs or day-old chicks is of great importance in the distribution of tuberculosis. The lungs of birds are seldom affected and the germs are usually discharged through the droppings. Therefore the feeding and drinking habits of the domestic fowl and the intensive methods used in raising them are largely responsible for the disease being so widespread. In the Northwest the birds are of necessity, because of weather conditions, kept closely confined most of the year. This perhaps contributes to some extent to the difficulty of controlling the infection.

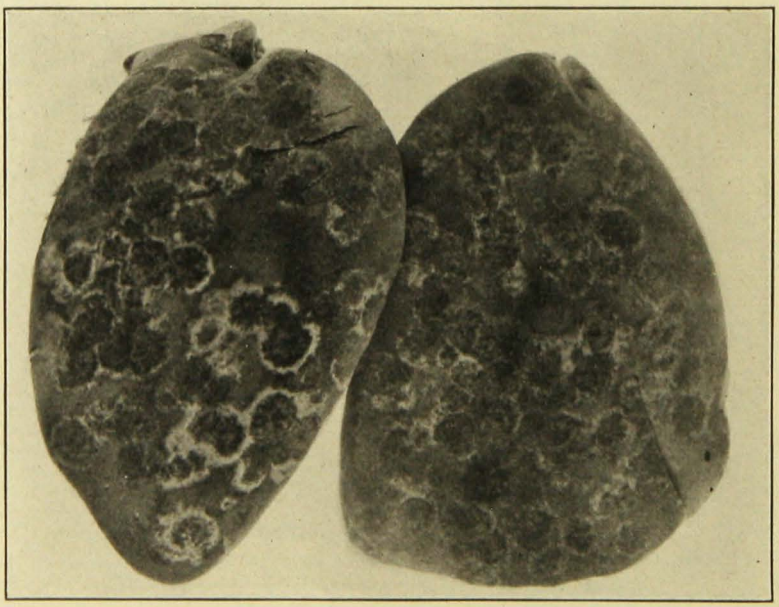

Fig. 10. Liver Showing Lesions of Blackhead
Refer to Figure 3 and note differences.

HOW TO DISTINGUISH TUBERCULOSIS FROM OTHER DISEASES

Blackhead.—To the inexperienced, blackhead, a contagious disease of turkeys and chickens, might be mistaken for tuberculosis. In this connection it should be kept in mind that blackhead is rarely if ever found among chickens unless they are raised in close contact with turkeys. The only organs affected in blackhead are the

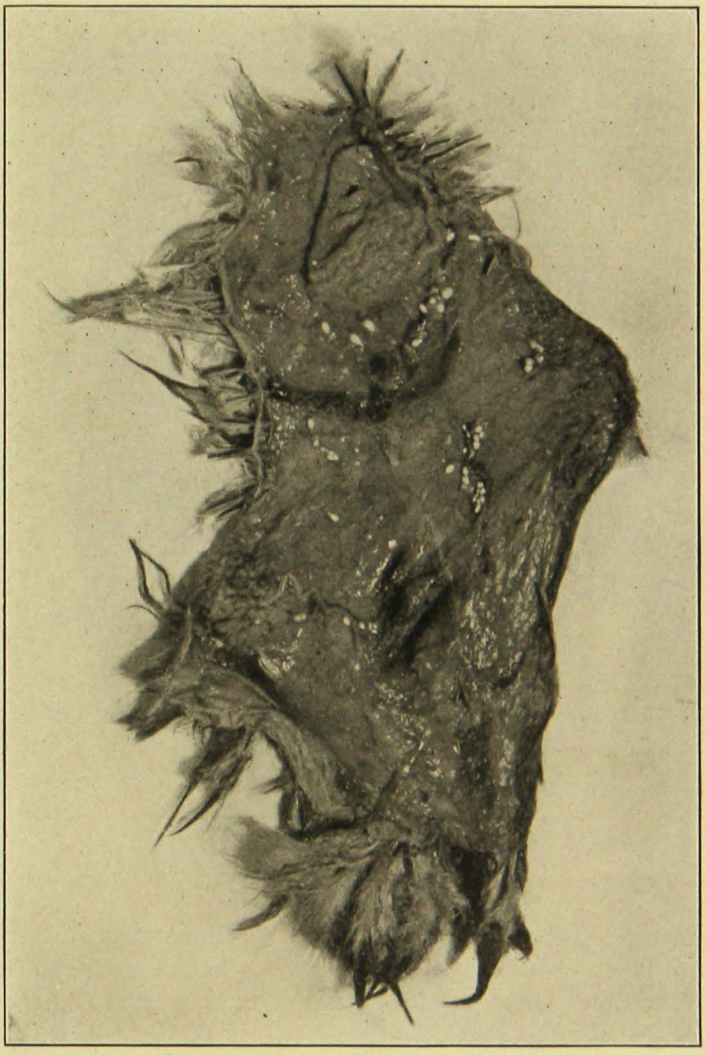

Fig. 11. Under Side of Skin Showing Nodules of Connective Tissue Mites
They are yellowish-white seed-like bodies

liver and caeca. The caeca are those parts of the lower intestine which contain two blind sacs or pouches 3 or 4 inches long. In blackhead these sacs are usually found to be greatly distended and badly decayed or dead. The most conspicuous change, however, is noted in the appearance of the liver. It is not so much enlarged as in tuberculosis. The liver contains round greenish yellow spots or areas. These are not hard or raised above the surface as in tuberculosis, nor do they have the same hard yellow centers (see Fig. 10). Rather they are soft and mushy. They may be only a few of these spots, or the whole surface of the liver may be covered. Thinness is not so pronounced as in tuberculosis and blackhead kills birds much more rapidly. The spleen and lungs are not affected.

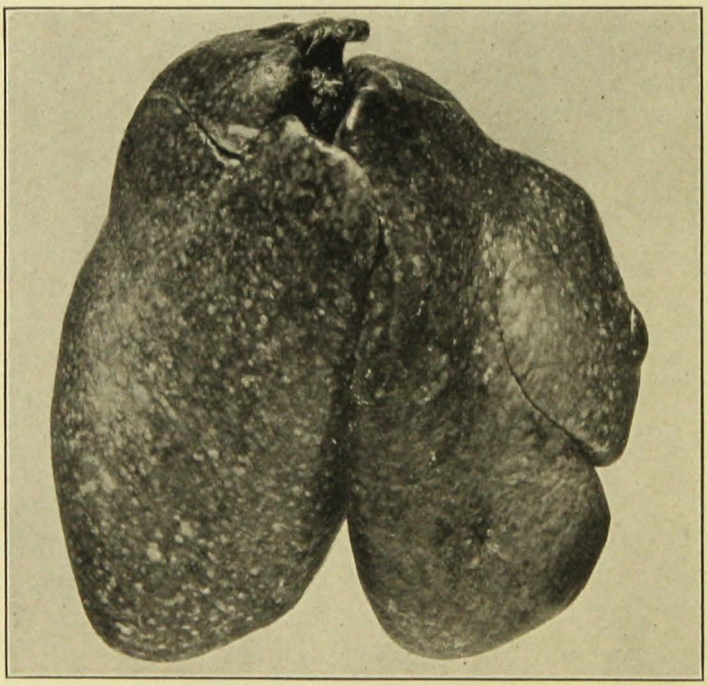

Fig. 12. Tumor or Cancer of the Liver
Note that in Figure 3 the nodules are raised above the surface while these are not.

Connective tissue mites.—Many times either in the examination of a dead bird for disease or the preparation of a fowl for the table, the skin becomes torn and in the loose connective tissue underlying the skin are noticed small yellowish white bodies about the size and shape of a small cucumber seed (see Fig. 11). Their number varies. It is usually quite by accident that they are discovered and

they are often confused with tuberculosis. These seed-like bodies are the remains of a chicken mite which normally lives on the outside of the body. Some of them, however, burrow underneath the skin and die. Their bodies become covered with a hard gritty material giving the characteristic shape and color. They are not harmful unless present in very large numbers. Most birds, especially the older ones, harbor them, but it is seldom they are discovered.

Tumors.—Tumors involving the liver, ovaries, or intestines have often been mistaken for tuberculosis. While somewhat similar they may be easily distinguished. The tubercular nodule usually has a gritty yellow center. The tumor is often white in color and may be hard and fibrous in character (see Fig. 12). In tuberculosis, deaths occur in ever increasing numbers, while a death due to a tumor would be an isolated one and tumors are not contagious.

Control and eradication

If the presence of the disease in the flock is suspected, send a sick or a dead bird to the Veterinary Division, University Farm, St. Paul, for examination. Live ones should be sent by express. Dead ones may be sent by parcel post.

It is of no use to attempt the treatment of sick birds with any medicine or tonic. There are plenty of remedies on the market but they are of no value. Once a bird has become infected, there is no cure, and all efforts should be directed toward preventing healthy ones from contracting the disease.

There are three ways in which the disease may be eradicated. (1) If the flock is small and not of great value, and if several birds have died or are infected, it would probably be best to destroy the entire flock and start over again. (2) If the flock is large or valuable, eradication may be attempted by means of physical examination without destroying the entire flock. This method requires the utmost care and attention to the smallest details for its success. It is hard work and there are many discouragements. (3) The tuberculin test may be applied to a flock that is valuable from a breeding standpoint. The first method is usually the most successful.

If it is found advisable to destroy the whole flock, the birds should be carefully examined and those free from extensive lesions may be used for food. Before beginning anew, see that the house is well scrubbed out with soap and hot water and then thoroly disinfected. A 5 per cent solution of any of the common coal tar disinfectants, such as cresol or carbolic acid, will do. The walls should then be whitewashed. If the floor is of dirt, remove about six inches and bury it. Resurface with fresh clean soil. If the floor is well

made of either concrete, tile, or wood, clean, and then soak with a disinfectant. If the floor is not of good material and is hard to clean, lay a new one over the old. Turn over the soil in the runs. Boil all the drinking cups and clean the other utensils. When this is well done and a few weeks have passed, procure new birds, being careful to get them from a flock free of the disease.

If the second method is to be tried and an attempt made to weed out the infected birds, they must be carefully examined by hand, paying close attention to the physical condition of each one. Examine for paleness of comb and wattles. Examine breast muscles and liver with the hand, also the joints for enlargements and lameness. Pick out one or two that appear to be diseased, kill them, and make a careful examination. If you have been correct, you readily gain confidence, and further examinations will be more quickly and accurately made. Some of the infected birds will be missed on the first examination, but they will be observed later when the symptoms are better developed. This must be repeated often. At the same time clean up and disinfect as already noted. Keep the floor as free from droppings as possible and clean it thoroly at least once a week. Do not allow the young birds to run with the older ones for they are easily infected. It is possible to wipe out the disease if the work is done carefully. Great patience and watchfulness is necessary. After the first general weeding out, watch the other birds, and as soon as one appears affected, remove it from the rest of the flock and keep it alone. If it develops further symptoms, kill it at once and burn the carcass. Do not leave it where the other birds may come in contact with it. A dark or poorly lighted chicken house is a friend of the germ of tuberculosis. See that the sunlight penetrates all parts of the house at some time during the day if possible, and provide plenty of fresh air. Use a drinking vessel that can be easily kept clean and free from droppings.

The third method is the application of the tuberculin test to the whole flock and the removal and destruction of those birds which react to the test. The test should be repeated every three to six months until the flock is free from tuberculosis. This method of eradication is probably of most value when used together with the culling process.

THE TUBERCULIN TEST

The test is similar to the "intra-dermal" method used in testing cattle for tuberculosis. The tuberculin used is prepared by growing the germ artificially. The organisms are killed and filtered out and what remains constitutes the tuberculin. No fear need be felt that

this material can cause tuberculosis, because it does not contain any of the germs and is rendered sterile by the application of heat. It can not, therefore, produce the disease.

The test, if properly performed, is very valuable in picking out the affected birds. The process, however, is rather difficult to the beginner and should be applied by some one with previous experience. A small hypodermic syringe (see Fig. 14) of about 1 cc. or less capacity and a twenty-six gauge needle are necessary. The important part of the procedure is the proper placing of the tuberculin in the skin. It should not be under the skin, but rather in it.

Fig. 13. Tuberculin Test

Tuberculin was injected into the wattle at the reader's left. Compare with the right wattle and note the thickening of the injected one. This fowl was found to be tuberculous.

Either the comb or the wattle may be used. The wattle is the easiest handled. The point of the needle should be inserted as easily as possible into the skin but not under it. Enough of the tuberculin should be forced in, to produce an enlargement about the size of a small pea. This is usually about 1/20 cc. Use only one of the wattles. The other is left for later comparison. If the bird is tuberculous there will be a swelling at the point of injection of the tuberculin in from 48 to 72 hours. The test is negative when the wattle has undergone no change and is the same as the wattle receiving no tuberculin. In reading the test it will be found that the increase in size of the wattle (see Fig. 13) is due more to a thickening of the wattle than a definite nodular swelling. If applied and interpreted properly, this test is of very great value in the control of tuberculosis. The injection has no ill after-effect on the birds.

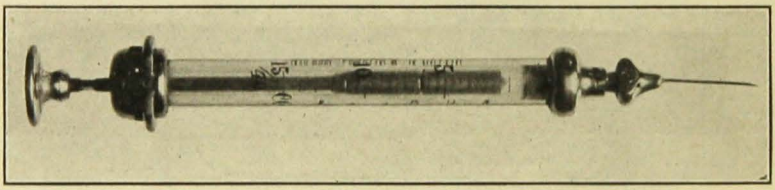

Fig. 14. Syringe Used in Tuberculin Test
Capacity is 15/40 cc. together with 26 gauge needle.

HYGIENE

The question is often asked as to whether eggs from a tuberculous flock are fit for food. While it has been shown that the germs are sometimes present in eggs, they are very rarely found. As a rule badly diseased fowls are not layers. Few eggs are eaten raw and the cooking process should destroy any germs which might be present. The same thing applies to the flesh of the fowl. Not many people would care to eat a bird with diseased internal organs. However, if these are removed and destroyed the flesh of the bird, if thoroly cooked, should be edible.